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U. S. DEPARTMENT OF COMMERCE
ALEXANDER B. TROWBRIDGE, Secretary
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
ENVIRONMENTAL DATA SERVICE

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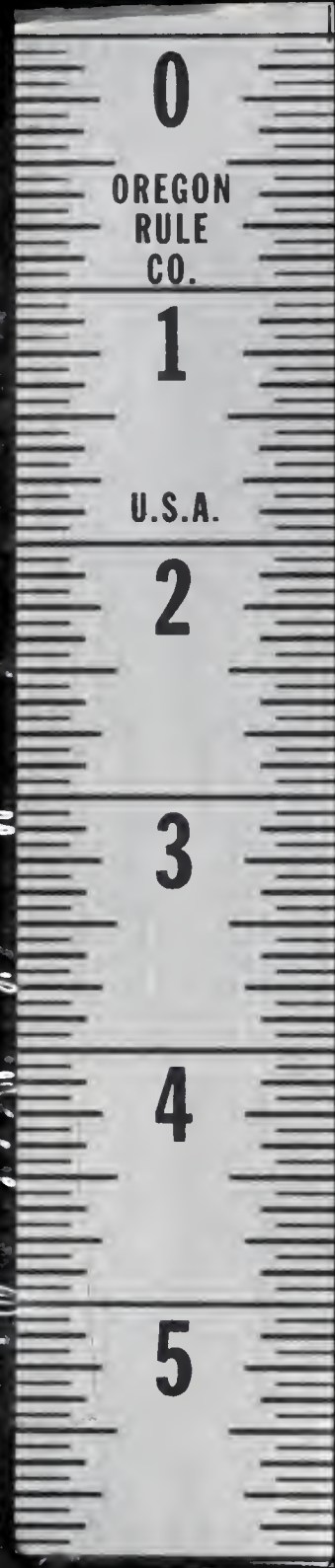
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U. S. DEPARTMENT
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MONTHLY CLIMATIC DATA FOR THE WORLD

Sponsored by
World Meteorological Organization
In Cooperation with
Environmental Science Services Administration

1967 SUPPLEMENT

Computation of Climat Temp Values



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P R E F A C E

The WMO Commission for Climatology, at its Fourth Session, August 1965, supported a proposal arising from CAe-IV and requested the Secretary General to conduct a survey of methods currently used by Members for computing CLIMAT TEMP values. It was further suggested that the results of this survey should be published, possibly as a supplement to Monthly Climatic Data for the World.

As a result of the request from CCL to carry out this proposal, the WMO Secretariat made out a survey of the methods used by national Meteorological Services for the computation of the monthly aerological means contained in CLIMAT TEMP reports, including hours of observations used and the procedures followed in the case of missing data.

The following report summarizes the replies from 72 national Meteorological Services.

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INFORMATION ON METHODS AT PRESENT USED FOR THE COMPUTATION
OF MONTHLY AEROLOGICAL MEANS IN "CLIMAT TEMP" REPORTS

Part 1. The Meteorological Services of the countries or territories below have provided information on the methods in use for computing their monthly aerological means in CLIMAT TEMP reports. Relevant extracts from their replies are reproduced in Section 3.

WMO Members:

Afghanistan
Algeria
Argentina
Australia
Austria
Belgium
Canada
Congo, Democratic Republic of
Czechoslovakia
Denmark
Finland
France
Germany, Federal Republic of
Greece
Hong Kong
Hungary
Iceland
India
Iran
Ireland
Israel
Italy
Japan
Jordan
Kenya
Lebanon
Madagascar
Mauritius
Morocco
Netherlands

WMO Members:

Netherlands Antilles
New Caledonia
Nigeria
Norway
Pakistan
Philippines
Poland
Portugal
Portuguese East Africa (Mozambique)
Portuguese West Africa (Angola)
Romania
Saudi Arabia
Senegal
South Africa
Southern Rhodesia
Spain
Sudan
Sweden
Switzerland
Tanzania
Thailand
Tunisia
Turkey
Uganda
U.S.S.R.
United Arab Republic
U. K.
U. S. A.
Venezuela
Vietnam
Yugoslavia

Non-Member:

Eastern Germany

Part 2. The following countries do not issue CLIMAT TEMP reports at present and have accordingly no information to provide:

WMO Members:

Albania
Cambodia
Ecuador
El Salvador
Ghana
Honduras
Indonesia
Kuwait
Luxembourg
Surinam

Part 3. Relevant information is given below in the same order as in the list of countries and territories in Section 1.

WMO Members

AFGHANISTAN

Monthly aerological means for CLIMAT TEMP reports are determined as follows:

- (a) We find the monthly mean surface pressure of a station, heights of the standard isobaric surfaces, temperature, dew point, on the basis of the daily averages;
- (b) In order to find the mean wind direction and mean wind speed, we find their vector resultant. The direction of the mean resultant is the mean direction of the wind; the magnitude of the resultant is divided by the number of observations, and thus we find the magnitude of the mean wind speed.

ALGERIA

Means are computed only when at least 10 daily values are available and when there is no 5-day period without one observation. This practice would seem acceptable and does not result in major errors, particularly in calculations of resultant wind, as the successive waves of the polar front reach our country in a weakened form.

ARGENTINA

- (a) Hours of observation

The Argentinian Meteorological Service computes CLIMAT TEMP reports for each of the hours of observation, i.e. 0000 GMT and 1200 GMT.

- (b) Observations missing

Wind: the various parameters are calculated whenever fifteen (15) or more observations are available.

ARGENTINA
(contd.)

Other aerological elements:

In these cases the critical limit is 25 observations.

AUSTRALIA

Monthly aerological means contained in CLIMAT TEMP reports from Australian stations are the means of the available daily values measured at 2300 GMT daily, provided that at least ten values are available and that there is no period of five consecutive missing values. Values are not estimated in the case of missing observations.

AUSTRIA

Monthly mean values of geopotential, temperature and dew point temperature (the last one only up to the 500 mb level) are calculated first for the hours 0000 GMT and 1200 GMT separately. These values are combined to the monthly over-all mean. The same method is used for the calculation of the vector wind components which are combined to the monthly over-all mean vector. As during the latest years about 70 percent of our soundings reached 10 mb, all mean values are averages based on at least 20 ascents for each sounding hour.

BELGIUM

- (a) The soundings of 0000 GMT and those of 1200 GMT are dealt with separately;
- (b) No means are given if less than 10 values are available or if there are more than 5 consecutive days without values (this rule is applied separately to the 00 GMT soundings on the one hand and to the 12 GMT soundings on the other hand).

CANADA

- (a) Canadian CLIMAT TEMP data are computed from values obtained from one observation per day taken at 1200 GMT, this being the standard hour of observation when radiational effects are a minimum for the country as a whole.
- (b) Interpolated temperature values for levels within missing temperature data strata, dew point values based on "statistical" values determined for the United States Weather Bureau type radiosonde when the humidity is below the recording range of the instrument, and values for altitude and temperature extrapolated according to procedures as set forth in Resolution 27 (EC-IX) are included when computing the monthly means of altitude, temperature, and dew point.
- (c) Values for mean surface pressure, altitude, temperature, and dew point are computed whenever there are ten or more daily values for the parameter, with no continuous period of more than five days without an assigned value.

Values for vector mean wind are computed whenever there are twenty or more daily wind values

CANADA
(contd.)

with no continuous period of more than five days without an assigned value.

- (d) Vector mean wind values are computed by first grouping all the wind reports into twelve 30-degree direction groups, determining the total north and west components of each of the twelve groups, computing the mean north and west components and thus deriving the vector mean wind.
- (e) Values of vector mean wind speed and scalar mean wind speed both computed to the tenth of a metre per second are used in the computation of the steadiness factor.

CONGO, Democratic Republic of

- (a) Aerological means are computed according to the method described in Volume B - Codes of WMO Publication No. 9. TP.4;
- (b) A CLIMAT TEMP is made for each hour of observation;
- (c) Only soundings having reached the 100 mb surface are taken into consideration for computing monthly means of CLIMAT TEMP. The mean is based on the number of soundings having met this requirement.

CZECHOSLOVAKIA

For the computation of the monthly aerological means contained in CLIMAT TEMP reports routine statistical methods are being used by our Service. The means are computed by dividing the sums by the number of entries. They are computed for two decimal places and then rounded off. For the computations the data are used from 0000 and 1200 GMT.

In case some data are missing from some surfaces, the sum is divided by the number of entries as described above. When more than one-third of observations or more than 5 successive observations from one observation hour are missing, then the surface concerned is not considered at all.

DENMARK

CLIMAT TEMP reports are calculated at all upper air stations in Denmark (including Faroe Islands and Greenland).

At 00 GMT and 12 GMT radiosonde ascents are carried out every day. Separate mean values are computed for the two daily soundings. The monthly mean values of geopotential height, temperature, dew point and wind vector are only computed, if there are less than 10 daily values missing, and there is not a period of 5 subsequent days with missing values.

In the report is given the average of the mean values at 00 GMT and 12 GMT. If there are too few daily values to compute one of the mean values, the other is given in the report.

FINLAND

Finnish CLIMAT TEMP data are computed from values obtained from two observations per day taken at 1200 and 2400 GMT. Values are not estimated in the case of missing observation. No means are given if there are more than 4 consecutive days without values.

FRANCE

The monthly means for CLIMAT TEMP are computed in the central office on the basis of observational data collected in this office daily.

Resultant wind is computed by using the usual trigonometrical formulae and introducing the direction "dd" (WMO code 0877) without change of sign or origin; thus the components of a wind blowing from the north-east are both positive.

For stations making 00 GMT radiosonde observations, the night observations only are used. For stations where no night observations are made, the 12 GMT radiosonde observations are used. In all cases, the hour is indicated in the written confirmation copy sent to the centre in Asheville (U.S.A.).

The means are included in the CLIMAT TEMP messages, only when at least 10 daily values are available and when there is at least one observation in each period of 5 consecutive days. Before 1964, resultant wind was transmitted only when at least 20 daily values were available and when there was at least one observation, in each period of 5 consecutive days. Since the number of observations has been indicated in the written confirmation, the general rule was also applied to the transmission of resultant wind, but it is suggested to come back to the use of the above restrictive rule.

GERMANY, Federal Republic of

CLIMAT TEMP reports are provided by all aerological stations of the Deutscher Wetterdienst.

Two radiosonde ascents are carried out every day at 0000 and 1200 GMT; they are both used for the computation of the mean values.

Only in the case of the ascents at Berlin-Tempelhof use is made of interpolation from the synoptic and aerological charts. At the remaining stations, the geopotential altitudes and temperatures are only interpolated for the following pressure level which had not been reached. Omitted measurements of the wind at 0000 and/or 1200 GMT are substituted by measurements carried out 6 hours before or afterwards.

The mean values of geopotential height, temperature, dew point and wind vector are only computed if there are not less than 10 values available and if in addition there is not a period of 5 subsequent days with missing values.

In the "Deutscher Wetterdienst" four wind measurements by radar are carried out per day at 0000, 0600, 1200, and 1800 GMT. The wind group is computed on the basis of wind measurements by radar at 0000 and 1200 GMT according to the trigonometrical

GERMANY
(contd.)

procedure.

GREECE

The method used for the calculation of CLIMAT TEMP messages (aerological means) is the one given in Volume B - Codes of WMO Publication No. 9.TP.4, with the exception that for the level of 50 mb and 30 mb mean values are also calculated in some cases in which the available observations are less than 20.

The hours of observations are 0000 and 1200 GMT. Missing observations are not interpolated.

HONG KONG

With the exception of the wind observations, all the monthly aerological means contained in the CLIMAT TEMP reports are the average values of the daily observations obtained from our routine ascents made at 0000 GMT. The mean winds given in these reports are the vector means of the daily values. In the case of missing data, the procedure laid down in Volume B - Codes of the WMO Publication No. 9.TP.4 is followed.

HUNGARY

Since 1 January 1966, the monthly means of the radiosonde stations of Budapest-Lorinc (12843) and of Szeged (12982) are computed from the measurements of 00 and 12 GMT. In the evaluation of the measured data, no inertia-corrections have been applied, while radiation corrections have been applied in Budapest since 1 May 1966 and in Szeged since 1 June 1966.

The missing high-level wind data have been - if possible - interpolated from data of wind measurements carried out between above-mentioned standard times (06 and 18 GMT). The missing data of the other elements have not been interpolated. The letters (a, b, c, d) published in Monthly Climatic Data for the World are referred to the number of days of measurements (not to that of the single measurements) on the data of which the mean values are based.

The mean values of geopotential, temperature and dew point are obtained from the average of mean values computed separately for the two times of observation since 1 January 1966, while the values of the resultant wind are obtained by averaging all of the wind data measured at the two times, i.e. the sum of the measured data divided by the number of the cases.

ICELAND

The CLIMAT TEMP data for Keflavik Airport, which is the only upper-air station in Iceland, are based on 4 daily observations made at 0000, 0600, 1200, and 1800 GMT.

Monthly means for height, temperature and dew point of standard levels are computed separately for each hour of observation and values given in CLIMAT TEMP messages are combined means for the fixed

ICELAND
(contd.)

hours of observations. No means are computed if observations are missing for more than 10 days or for 5 consecutive days. Values are not interpolated when data are missing.

Mean vector wind and steadiness factor are also derived from 4 daily observations. Every wind observation is broken down in north and east components and the mean vector wind calculated from the mean east and north components.

After routine checking all observations are punched on IBM cards and the CLIMAT TEMP data are computed on an electronic computer.

INDIA

(a) Surface data

In the CLIMAT TEMP reports monthly mean data relating to surface were introduced from January 1964.

In the reports for January, February, and March 1964, pressure, temperature, and dew point temperature means were based on 00 and 12 GMT observations taken at the time of the radiosonde ascents. But in the case of the monthly mean vector wind, the means were based on 12 GMT observations only. The steadiness of wind was calculated as per specification of r_f in Volume B - Codes of the WMO Publication No. 9.TP.4.

From April 1964 onwards all the data are based on both 00 and 12 GMT observations. Whenever data are missing, no assigned values have been taken.

In the case of pressure, temperature, and dew point, means are not calculated when the number of days of observation is less than ten in a month or when observations are missing for a continuous period of five days or more. This is in accordance with Note (3) under PP in Volume B - Codes of WMO Publication No. 9.TP.4. In the case of vector mean wind, means are not calculated when more than 10 daily values in a month are missing or when observations are missing for a continuous period of 5 days or more. This is in accordance with paragraph 11.5 of the WMO Guide to Climatological Practices (WMO No. 100.TP.44).

(b) Dynamic heights, temperatures and dew point temperatures at standard pressure levels.

From August 1948 to December 1948 the average daily values were based on 0300 GMT observations and from January 1949 to March 1957 on 1500 GMT observations. Thereafter up to the end of 1962, the average daily values were based on 1200 GMT observations. From January 1963, both 0000 and 1200 GMT observations were used for calculating the average daily values when both are available and when only one observation was available that was taken as the average daily value.

When observations are missing assigned values have not been deduced. The monthly means are

INDIA
(contd.)

calculated only when at least 10 daily values for the month are available with no continuous period of 5 or more days with missing values.

- (c) Vector mean wind and steadiness of wind at the standard pressure levels.

These are being included in the CLIMAT TEMP reports from January 1964. For January, February, and March 1964, the vector mean winds were calculated from the 1200 GMT observations. From April 1964 onwards they are calculated from the average values of 0000 and 1200 GMT observations.

For missing observations no assigned values have been deduced. Vector mean winds are not calculated when more than 10 daily values are missing or when there is a continuous period of five days or more when values are not available.

The steadiness of wind is calculated in accordance with the specification of r_f in Volume B - Codes of the WMO Publication No. 9.TP.4. For publication in the "Monthly Climatic Data for the World", checked values of the CLIMAT TEMP data are sent. The number of days of data used in computing the means are also indicated.

IRAN

The method at present used for computing CLIMAT TEMP values is as follows:

- (a) CLIMAT TEMP reports are provided presently only by the aerological station at Tehran (40-754), however, reports will be prepared by each station of the overall aerological network within the near future.
- (b) Two radiosonde ascents are made at Tehran every day at 0000Z and 1200Z and separate reports are prepared for 0000Z and 1200Z ascents.
- (c) Mean values of pressure, temperature, and dew points are manually computed from the observational record of each month.
- (d) Observed winds are converted into North and East components using tables; the mean resultant is found to nearest 10 degrees and whole knots.
- The steadiness factor is computed.
- (e) The values obtained are coded according to FM 75C and include surface values.
- (f) If there are less than 10 observations at any level available, data for that level is not included. No interpolation is made for missing data.

IRELAND

The CLIMAT TEMP data for Valentia Observatory which is the only upper-air synoptic station in this country, are based on observations which are made twice daily at 0000 and 1200 GMT.

The procedure for dealing with missing data is as

IRELAND
(contd.)

follows:

When the value for any level in one ascent is missing (0000 or 1200 GMT) the value available for that level in the other ascent (1200 or 0000 GMT) is taken as the mean for the day. Monthly means are computed, provided values are available for at least 10 days.

The number of days on which the monthly means are based are indicated by means of letters a, b, c, or d with the following meanings:

- | | |
|---|---------------------------------|
| a | 25 or more days of observations |
| b | 20 to 24 days of observations |
| c | 15 to 19 days of observations |
| d | 10 to 14 days of observations |

ISRAEL

Aerological means computed by this Service for the monthly CLIMAT TEMP reports are based upon the ascents of 1100 GMT alone. At least 20 observations are required for the computation of a monthly mean. Resultant winds are computed by a graphical method by means of the Molchanoff disk.

ITALY

The CLIMAT TEMP messages provided by the Italian Service refer to the monthly means of data supplied by its radiosonde stations (UDINE, MILANO/Linate, ROMA/Fiumicino, CAGLIARI/Elmas, BRINDISI and MESSINA).

The calculation of the monthly means is carried out by means of an I.B.M. 1401 electronic computer and in accordance with the WMO Regulations and instructions including those relating to the possibility of evaluating, by means of suitable aerological charts, any missing data through proper analysis and possible interpolation. Specially, the mean values of elements for single levels are first calculated separately for the observation hours (0000 GMT, 1200 GMT), then globally. In this way the computer points out for each level - from a pre-planned programme - those elements which have been missing for more than five consecutive days. When this occurs, such elements are excluded from the message.

JAPAN

Daily values at 1200 GMT are averaged for each standard level. However, when the daily values at 1200 GMT are available only for 19 days or less of the month, or when they are missing on five days or more consecutively, even if they are available for more than 19 days of the month, the monthly mean will not be reported. (Missing daily values are not substituted by those at other hours in the calculation).

JORDAN

Methods used in this department for the com-

JORDAN
(contd.)

putation of the monthly aerological means in CLIMAT TEMP are in accordance with the practices recommended in the Guide to Climatological Practices (WMO No. 100. TP.44).

Time of release: the radiosonde are made at 11:00 GMT and 23:00 GMT.

Means included in the CLIMAT TEMP were based on the 23:00 GMT ascent for the period July 63 - April 66, and were based on two ascents 11:00 GMT and 23:00 GMT with effect from May 1966.

Mean value obtained is given as the monthly mean provided that at least 10 individual values are available.

In case of missing data, no values are estimated.

Dew point value less than -45°C could not be evaluated and considered as missing data.

KENYA

Only one radiosonde ascent per day is made at each of the three stations under the control of the East African Meteorological Department:

Entebbe 63705, Nairobi/Dagoretti 63741, Dar es Salaam 63894. The sparsity of the aerological network in this area makes it impossible to interpolate missing daily values; where all daily values are not available, the Department follows the procedure described under PP, paragraph (3) (b) in Volume B - Codes of the WMO Publication No. 9.TP.4.

Particular points to note regarding the three CLIMATIC TEMP stations are:

Nairobi/Dagoretti (63741) : Ascents are made once daily at 0000 GMT during darkness, no radiation corrections being necessary. The type of instrument used was changed from Kew Mark II B to Vaisala Oy on 8 September 1965.

Entebbe (63705) : Ascents are made once daily at 1200 GMT in daylight and radiation corrections are applied. Instrument changed from Kew Mark II B to Vaisala Oy on 11 February 1966.

Dar es Salaam (63894) : Ascents are made once daily at 1200 GMT in daylight, and radiation corrections are applied. Instrument changed from Kew Mark II B to Vaisala on 5 June 1964.

LEBANON

(a) Aerological observations are made daily at 1200 GMT; the monthly means for geopotential, temperature, and dew point are arithmetic means.

(b) Wind observations are made by radar. For computing values of vector mean wind, the daily vector is converted into rectangular components and at the end of each month, the vector mean wind is calculated taking due account of the following condition. Vector mean winds are computed each time when at least 20 daily wind observations are available, provided there is no period of five consecutive

LEBANON
(contd.)

days during which wind data are lacking.

MADAGASCAR

(a) The time of observation is 0000 GMT; the time of release of the sonde is 2300 GMT approximately;

(b) In the case of missing values, the mean value is given as the monthly mean only when at least 10 individual values are available.

When at one or more specified surfaces no sufficient data are available to compute the means, the corresponding monthly means are coded /// or //// as appropriate.

MAURITIUS

(a) All regular ascents are made once daily at 0000 GMT. Any special ascents at other times are not included in the computations of CLIMAT TEMP reports;

(b) There are very few observations missing at lower levels and these are ignored in the computations. At standard levels above 100 mb, the report is given only if there are at least 10 observations fairly evenly distributed over the month;

(c) The report is computed from the individual daily observations recorded to the first decimal point in the case of atmospheric pressure, temperature, and dew point and to the nearest geopotential metre in the case of height. The east and north components of wind are recorded for each day and each level to the nearest tenth of a knot. The arithmetic mean of all the daily records is given in the CLIMAT TEMP message except in the case of the arithmetic means of the north and east components of wind which are used to find the resultant wind speed and direction.

MOROCCO

In the case of missing data, the following rules are applied in the computation of the aerological means contained in CLIMAT TEMP reports:

(a) The mean value obtained is given as the monthly mean provided that at least 10 individual values are available and that there is no period of 5 consecutive days without an assigned value.

(b) Exceptionally, to meet the latter requirement one or more missing daily values may be defined by interpolation with the aid of aerological maps.

NETHERLANDS

From February 1966 onwards, the Netherlands use the following methods for the computation of the monthly aerological means contained in CLIMAT TEMP reports, issued from Netherlands stations.

In respect of temperature, dew point and geo-

NETHERLANDS
(contd.)

potential, the means are based on observations made at 0000 GMT. Observations made at other hours are used to replace missing observations, but only to the extent necessary to satisfy the minimum requirements for a mean to be computed, and then only up to and including the 200 mb surface. In reality, this procedure is never necessary in this country.

In respect of wind, all available observations on each day are used for computing a daily mean, the daily means then being used to compute the monthly mean. Values of wind obtained by interpolation from synoptic charts are not used for days with no observations.

Regarding the minimum number of observations required for computing CLIMAT TEMP messages for all parameters other than wind speed and direction, it is considered that there should be at least 10 days with observations and that for wind speed and direction, there should be at least 20 days with observations; in all cases there should be no period of 5 consecutive days without at least one observation.

Prior to 1964 nearly, the above described procedures have been used to compute the means for the CLIMAT TEMP reports, but during the period January 1964 to January 1966, the observations of 0000 and 1200 GMT together have been used to compute the means of temperature, dew point, and geopotential. For these two years the means will be recomputed using only the 0000 GMT observations.

NETHERLANDS ANTILLES

The computation of means is dealt with by the U. S. Weather Bureau since the upper-air stations within the territory of the Netherlands Antilles are co-operative stations under the U. S. Weather Bureau and the National Meteorological Service.

NEW CALEDONIA

The methods used for computing aerological means for CLIMAT TEMP reports, are those described in Chapter 10 (paragraph 10.6.1) of the Guide to Climatological Practices (WMO No. 100.TP.44).

The time of release of the only radiosonde made at Noumea is 23 GMT.

In the case of missing data, no values are estimated.

NIGERIA

(a) The computed values in the CLIMAT TEMP are the arithmetic mean of the daily values recorded at the regular hour of ascents. Only the 1200 hour ascents are used. The monthly mean vector wind is given, wherever available, and is computed from the resolved components of daily wind values.

(b) The available daily values only are used and no assigned values are reduced by interpolation from aerological or synoptic charts, but we observe the rule that not less than 10 individual values are available and there is no

NIGERIA
(contd.)

continuous period of 5 days with missing values.

NORWAY

The methods for computation of monthly aerological means contained in CLIMAT TEMP reports are:

(a) Elements and levels : Data included are monthly mean values of height, temperature, dew point, steadiness factor of wind, and vector mean wind for the standard pressure levels : surface 850, 700, 500, 300, 200, 150, 100, 50, and 30 mb if available.

At surface, pressure reduced to station level is given instead of contour height;

(b) Data included in the means : Data from all ascents at synoptic hours 0000 and 1200 GMT (for ocean weather ships also upper winds at 0600 and 1800 GMT) are used for computing the monthly means specified in paragraph (a) above. Values for surface are observations taken at the time of release of the radiosondes. If more than one ascent has been made at synoptic hours on any day, the data used in computing the means are those for the ascent reaching the higher level;

(c) Dew point is not included when dry bulb temperature is below -40°C ;

(d) Missing observations : If radiosonde data for some days of the month are missing, the monthly means of the values available are computed, provided that:

(i) not less than 10 individual days are available on which observations were made at both 0000 and 1200 GMT, and

(ii) there is no period of 5 or more consecutive days without an assigned value (i.e. observed or interpolated).

The mean dew point is not computed for any level at which the computed dry bulb temperature is below -40°C on 6 or more occasions in the month.

For upper winds, the following rules are applied : If, for some reason, data (observed and interpolated) for not all days of the month are available, the monthly means should be computed based on available data, provided that :

(i) one or more values for at least 20 days during the month are available, and that

(ii) there is no gap greater than 5 consecutive days without any information.

(e) Interpolated values : If more radiosonde data (0000 and 1200 GMT) as specified in paragraph (d) above are missing so that, according to the rules, no monthly means should be computed, interpolated values for the standard pressure levels 850, 700, 500, and 300 mb are used instead of observed values. Interpolated values for the standard pressure levels 200, 150, 100, 50, and 30 mb are at present not used. Interpolated values are used exactly as

NORWAY
(contd.)

observed values in computing the means.

For ocean weather ships, interpolated values are given only for synoptic hours 1200 GMT (not for observations which should have been made at 0000, 0600, and 1800 GMT), and only for standard pressure levels 850, 700, 500, and 300 mb.

(f) Computing procedure:

(i) The means for geopotential, temperature, and dew point are computed as the algebraic means of the month using all available data for the standard pressure levels in question. Units for geopotentials : 1 gpm, for pressure : 1/10 mb and for temperature and dew point : 1/10°C. The means are rounded off to appropriate units after the computation is completed;

(ii) Vector mean winds for the month is obtained by computing the mean components, (NS- and EW-components) for each day of the month, and then computing the monthly mean from the means of the individual days. The NS- and EW-components of each observation are determined either graphically or by means of component tables. The means of the individual days are given the same weight when computing the monthly mean if they are based on 1, 2, 3, or 4 observed or interpolated values.

Units used : for wind direction, whole degrees and for wind speed, whole knots. The monthly means are rounded to 10 degrees and to whole knots respectively, after all computations are completed.

PAKISTAN

The methods used in this Service for the computation of the monthly aerological means contained in CLIMAT TEMP reports are in accordance with the practices recommended in the Guide to Climatological Practices. The hour of observation is 0000 GMT only. For a continuous gap of five days, the data of that station are not computed. The missing data are reported with the number of appropriate X's.

PHILIPPINES

(a) The Philippine Meteorological Service commenced issuing CLIMAT TEMP reports for its two (2) radiosonde stations, Laoag (98223) and Zamboanga (98836) for the July 1966 observations. These reports are prepared and issued for the observations taken at 0000 GMT.

(b) The methods used in computing the aerological means contained in the CLIMAT TEMP reports are in accordance with the pertinent provisions of Volume B - CODES of WMO Publication No. 9.TP.4.

POLAND

The calculation of the monthly means of geopotential, temperature, dew point temperature, and the monthly means of wind vector at the given isobaric

POLAND
(contd.)

surfaces, transmitted in the CLIMAT TEMP reports, is made by way of arithmetic means:

- from a number of at least 20 values of a given element for the radiosonde stations taking observations twice daily at 11 GMT and 23 GMT (Poznan, Wroclaw, Legionowo),
- from at least ten values of a given element for the Koszalin radiosonde station which is taking observations once daily at 11 GMT.

For the calculation of the monthly mean wind vector, the method of the arithmetic means has been applied for the x, y components of the wind vector obtained from measurements.

PORTUGAL

The method used in this Service for the computation of the monthly aerological means contained in CLIMAT TEMP reports is the following : reported means of temperature, dew point and geopotential are obtained by arithmetically averaging those values observed in the daily sounding of 0000 GMT for Lisbon and of 1200 GMT for Funchal and Sal. The reported mean of wind is obtained by the vectorial mean of the values observed in the daily sounding of the same hour. The steadiness of wind is calculated in accordance with the specification of r_f in Volume B of the WMO Publication No. 9.TP.4. If more than ten values or if in a continuous period of five or more days data are missing, the mean is not reported. Radiation corrections are applied to day-time soundings for levels at and above 100 mb. Whenever the temperature is below -40°C, dew point is not calculated.

PORTUGUESE EAST AFRICA (MOZAMBIQUE)

As for Portugal. The hour of observation is 1200 GMT.

PORTUGUESE WEST AFRICA (ANGOLA)

As for Portugal. The hour of observation is 1200 GMT.

ROMANIA

(a) The CLIMAT TEMP data are based on daily observations made at 2300 GMT.

(b) The mean values of surface pressure, geopotential, temperature, and dew point are calculated each time there are at least ten daily values for each parameter and that there is no period of five consecutive days without data.

(c) The mean values for wind are vector means based on observations made at 2300 GMT. Resultant winds are determined by means of a graphical method using the Molcianov disc. The steadiness factor is defined by means of the values of the monthly mean vector wind and the monthly mean scalar wind and is expressed as a percentage.

SAUDI ARABIA

- (a) CLIMAT TEMP data are computed from available values of two ascents which are taken per day at 0000Z and 1200Z.
- (b) In the case of computing monthly aerological means, the procedure applied is in accordance with WMO Volume B Publication No. 9.TP.4 with the exception of the steadiness factor, which is not computed.
- (c) Paragraph 11.5 of the WMO Guide to Climatological Practices (WMO No. 100.TP.44) is applied in the case of missing data.

SENEGAL

- (a) Calculation of mean dew point temperature : For temperatures above -40°C , when relative humidity is less than 10 %, the dew point temperature is taken as the value obtained by using $U = 10\%$. The dew point value thus obtained is used for the calculation of $\overline{T_d T_d T_d}$.
- (b) Missing data :

At stations where daily ascents are made, the mean of the available values is given as a monthly mean provided that not more than 10 daily values are missing and that there is no period of five or more than five consecutive days without assigned value. If these conditions are not fulfilled for one of the parameters, monthly means are not calculated for the parameter in question.

At stations where the daily ascents are alternatively radiosonde and radiowind observations, monthly means for parameters other than wind are calculated, provided that not more than two values are missing. As regards wind, the conditions are the same as at stations making daily ascents.
- (c) Where two daily ascents are made, only the values of the 0000 GMT radiosonde observation are used.

SOUTH AFRICA

- (a) The observations are made at 1200 GMT and the computation of the monthly aerological means for geopotential height data, temperature data, and dew point data are based on the arithmetical means. The means are omitted from the message when daily data are missing for five consecutive days. In our national aerological publications, the latter rule is ignored as it would entail unnecessary programming for the electronic computer.
- (b) The computation of mean winds is done by arithmetically meaning the wind vectors. The conversion of the true wind to wind vectors is done on a slide rule. A programme for the electronic computer has already been written, which will eliminate this arduous task, but it cannot be introduced unless the broadcast of the CLIMAT TEMP message is either delayed from the 5th and 6th until the latter half of the month or discontinued altogether, in which case air mail exchange will suit us equally well.

SOUTHERN RHODESIA

The hour of observation for TEMP soundings is approximately 0500 GMT. This hour is dictated by staff problems, and the need for maximum national usefulness.

No substitution is made for missing observations, since :

- (i) TEMP stations are so widely spaced that interpolation from the network would be of doubtful accuracy;
- (ii) variability of temperature and therefore of geopotential in low latitudes is scarcely above instrumental resolution.

SPAIN

In the preparation and drafting of the monthly CLIMAT TEMP reports and the summaries for publication in "Monthly Climatic Data for the World", radiosonde stations are following the rules contained in the circular Volume I, Nos. 50 and 52 of January 1964 and April 1965, respectively, and drawn up in accordance with the specifications of Volume B - Codes of the WMO Publication No. 9.TP.4, and of the Guide to Climatological Practices (WMO No. 100.TP.44) and papers C-3.5 and C-3.3 (this last of July 1965) of the U. S. Weather Bureau.

SUDAN

CLIMAT TEMP values for Sudan Stations are the means of the available daily values measured at 1200 GMT, using Vaisala equipment, provided that there are at least ten values available and that there is no period of five or more consecutive missing values.

For surface, pressure reduced to station level is given, instead of the contour height. Dew points are not included when the temperature is below -40°C .

SWEDEN

In computing the monthly aerological means contained in CLIMAT TEMP reports, the Swedish Meteorological and Hydrological Institute follows the recommendations given in the Guide to Climatological Practices (WMO - No. 100.TP.44). The only exception is that no use is made of analyzed maps to obtain approximate values, if an observation is missing. The reason for this departure is that maps for the highest levels (100 mb and above) are not constructed on a routine basis.

Both hours of observations are used for the computation of monthly means.

SWITZERLAND

The present practice is to compute mean values for the hours of observations 0000 GMT and 1200 GMT, and subsequently the mean of the results thus obtained. Computation of the means and vector wind is done with an electronic computer. Standard surfaces, for which less than 20 values in a month are available, are eliminated.

TANZANIA

See information for East African Meteorological Department under KENYA.

THAILAND

- (a) In respect of temperature, dew point and geopotential, the means are taken from all available data at the same hour (0000Z, 1200Z). However, this is within the extent necessary to satisfy the minimum requirements for a mean to be computed;
- (b) In respect of upper winds, all available observations on each day are used for computing a daily mean, the daily means then being used to compute the monthly mean.

A table has been prepared for obtaining the east - west and north - south components of each wind observation. The mean monthly resultant winds are thus obtained from the average east - west and north - south components of all available winds during the month at various levels.

TUNISIA

Aerological means are computed on the basis of the data from each radio sounding or radiowind. The time of the aerological observation used is 2300 GMT. The number of observations required should not be less than 20 and the number of consecutive days with no observations should not exceed 5.

TURKEY

- (a) Monthly means are calculated for 0000 and 1200 GMT separately.
- (b) No interpolation is made in preparation of CLIMAT TEMP reports.
- (c) Values for less than 10 observations in a month are not included in CLIMAT TEMP reports; at least 10 non-consecutive observations are required. The following letters are used as prefixes to indicate the number of observations during a month:
 - a more than 25
 - b 20 to 24
 - c 15 to 19
 - d 10 to 14
- (d) A graphical method is used to compute the monthly means of wind direction and speed reported in CLIMAT TEMP.

UGANDA

See information for East African Meteorological Department under KENYA.

U. S. S. R.

The CLIMAT TEMP reports compiled at the aero-

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logical stations (radiosonde stations) of the Hydro-meteorological Services of the U. S. S. R. contain the average monthly pressure, air temperature, dew point, coefficient of wind steadiness, the direction and speed of the resultant wind at station level and the average monthly heights of isobaric surfaces, and also the air temperature, dew point, coefficient of wind steadiness and the direction and speed of the resultant wind at the level of various isobaric surfaces.

The calculation of the above-mentioned data is based on the observational data for 0000 and 1200 GMT (0300 and 1500 hours Moscow time).

The calculation of the monthly values for atmospheric pressure, the height of isobaric surfaces, the air temperature and the dew point is carried out by adding together the corresponding daily values for those times and dividing the total for the month by the total number of observations. If, for any climatic element, data are missing for a particular time or day, then the average value for the height of isobaric surfaces, air temperature or dew point is calculated from the observational figures available, provided there are not less than 30, for each of the following levels : surface, 850, 700, 500, 400, 300, 200, 150, 100, 50, and 30 mb.

Average monthly wind characteristics (the steadiness parameter, direction and speed of the resultant wind) are calculated from not less than 30 observational figures in a given month for the levels : surface, 850, 700, 500, 400, 300, 200, 150 mb and from not less than 10 in the month for the levels : 100, 50, and 30 mb. The resultant wind is determined by the average values of the component winds calculated by breaking down the wind vectors into eight co-ordinates. The coefficient of wind steadiness is given by the relation of the resultant speed to the average measured wind speed, and is expressed as a percentage.

UNITED ARAB REPUBLIC

The procedure followed in the Meteorological Department at Cairo in the computation of the monthly aerological means contained in CLIMAT TEMP reports is as follows :

- (a) The 0000, 1200 GMT ascents are used;
- (b) Wind components at the different levels are deduced from the sine and cosine four decimals tables;
- (c) Monthly means of other meteorological elements are extracted from the 0000, 1200 GMT observation as far as it is permitted in the Guide to Climatological Practice item 10.6.1;
- (d) In the case of a missing observation, its data is not extrapolated and it is considered a missing data.

UNITED KINGDOM

Current instructions for the computation of monthly means in CLIMAT TEMP reports may be summarized as follows (but some modifications may soon be made in respect of reports from Weather Ships A, I, J):

- (a) All values observed at a given level are included

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in the mean value for that level, without regard to the time of observation. However, in the case of winds, a daily mean is first taken and then the mean of the daily values. In the case of geopotential and temperature, means for the separate hours are taken first and then the mean of these;

- (b) Dew points values are limited to occasions when dry bulb temperature is not lower than -40°C .

When an observed value of relative humidity falls outside the limits of the table used for determining the dew point, no extrapolation is made, but instead the lowest value of dew point given in the table for the corresponding value of dry bulb temperature is used. At temperatures lower than -20°C , dew points which fall outside the limits of the table are omitted. When during any month the number of such cases at a given level exceeds 10 percent of the total number of dew point observations at that level, no mean value is given.

- (c) For missing values :

- (i) where possible, missing daily values are interpolated from synoptic and aerological charts;
- (ii) where all daily values are not available and cannot be deduced, the mean of available values will be given as the monthly mean value, provided that not less than ten individual values are available (but one or more values for each of at least twenty days during the month are required for winds) and provided that there is no continuous period of five days without an assigned value.

UNITED STATES OF AMERICA

Effective with data for May 1964, the monthly aerological means for the CLIMAT TEMP reports for almost all U. S. stations have been calculated centrally by the National Meteorological Center, Weather Bureau, ESSA, based on teletype writer reports received on standard channels for operational use in the Numerical Weather Prediction programme.

The incoming teletype writer reports of upper-air data are reviewed by a computer programme that applies a hydrostatic equation check to the temperature and geopotential data, and identifies values that exceed criteria. Dew point and wind data are checked also. Where necessary, geopotential values are re-computed, or deleted, temperatures and dew point temperatures are corrected or deleted (or are replaced by an analyst's guess, called "bogus" values), and wind values are replaced by wind data for the nearest reported altitude in the related upper wind report. Then data for the selected station list, for the designated observation time (1200 GMT for continental U. S. stations, 0000 GMT for Pacific area stations), are transferred to a separate magnetic tape file for summarization after the end of the month. Geopotential data are received (in the Radiosonde Synoptic Code) in whole geopotential metres to 500 mb, and in tens of geopotential metres for levels at 500 mb and higher. These are converted in the computer programme to tens of geopotential feet,

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(contd.)

and are stored in these units. The Radiosonde Synoptic Code provides the air temperature and the dew point temperature precisely to whole degrees Celsius but approximates the tenths of degrees. The coding error can be as great as $+0.2^{\circ}\text{C}$, but is generally $+0.1^{\circ}\text{C}$. Wind velocity is reported in the U. S. Radiosonde Synoptic Code only for mandatory levels; since the data for the surface is given in the first significant level groups, the wind value for the surface is not included. Consequently, resultant wind data cannot be computed for the surface for U. S. stations.

No attempt is made in this programme to interpolate values when entire soundings are missing. The mean of available values is computed and reported as the monthly mean provided that at least 10 daily values are available, and provided that there is no continuous period of 5 days without an assigned value.

CLIMAT TEMP data for United States stations in the Antarctic are calculated by hand at the observing stations. All upper-air observations for the month are used in the calculations (generally 0000 GMT and 1200 GMT daily). No attempt is made to interpolate missing values. The mean of available values is computed and reported as the monthly mean provided that values are available for at least 10 days, and provided that there is no continuous period of 5 days without an assigned value.

VENEZUELA

- (a) One radiosonde ascent is carried out every day at 1200 GMT.
- (b) The monthly means CLIMAT TEMP are computed in the Aerological Section of the Meteorological Service.
- (c) The means of available values are computed and reported as monthly means, provided that at least 10 daily values are available, and provided that there is no continuous period of 5 days without an assigned value.
- (d) Resultant wind is computed by the trigonometrical formulae.

VIETNAM

Procedures followed in the computation of aerological means when data are missing are those set out in the Guide to Climatological Practices (WMO - No. 100. TP.44).

YUGOSLAVIA

The deviation of our national practice in preparing CLIMAT TEMP messages from those described in Chapter 10 of the Guide to Climatological Practices (WMO - No. 100. TP.44) are as follows :

- (a) Till 1 October 1966, the computing of the mean values was carried out if at least five values were available in one term for geopotential and temperatures and at least ten values for the wind.

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(contd.)

- (b) Till 1 April 1966, the mean monthly value was computed from the sum of two terms.

After these dates, the procedure mentioned in Chapter 10 of the Guide to Climatological Practices has been applied completely.

NON-MEMBER

EASTERN GERMANY

- (a) Since 1 January 1965, aerological measurements are carried out as follows :

	00	06	12	18	GMT
10 184 (Greifswald)	RW	RW	RW	W	
10 393 (Lindenberg)	RW	RW	RW	RW	
10 454 (Wernigerode)	--	RP	--	--	
10 486 (Wahnsdorf)	RW	RW	RW	W	

- (b) For the computation of monthly means, values are used as follows:

- from 10 393 and 10 454: all available values;
- from 10 184 and 10 486: for $\overline{d_v}, \overline{d_v}, \overline{f_v}, \overline{f_v}$ all available values;

EASTERN GERMANY
(contd.)

: for $\overline{HHHH}, \overline{TTT}, \overline{T_d}, \overline{T_d}, \overline{T_d}$
only the values of the 00 and 12 GMT observation hours.

- (c) The mean values of the geopotential height, of the temperature and of the dew point are computed from the sums of the measured data used - irrespective of the observation hour.

The mean value of the dew point is computed from the means of temperatures and relative humidities.

- (d) The mean wind vector is computed from the sum of all wind components - irrespective of the observation hour.

- (e) With regard to "missing data", the procedure is as follows:

Monthly means (mean wind vector included) are reported :

- (i) if at least on ten days there is at least one daily value - irrespective of the observation hour;
- (ii) provided that there is no continuous period of five days without an assigned value - irrespective of the observation hour. In case of missing data, no interpolation is applied.

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